CLAIMS

1. A method for modeling a system using finite element techniques comprising:

defining a plurality of finite element meshes, wherein a plurality of nodes are common to at least two of the finite element meshes;

defining a property associated with each of the finite element meshes, wherein for each of the finite element meshes, the property is defined by a corresponding function which is independent of the other functions;

associating an evaluator with each of the finite element meshes; and

generating a solution for each of the finite element meshes, wherein for each of the finite element meshes, the function used to define the value of the property at each of the common nodes is selected according to the evaluator associated with the finite element mesh.

2. The method of claim 1 wherein defining the plurality of element meshes comprises defining all nodes on boundaries between the finite element meshes to be common to the finite element meshes which touch the corresponding boundaries.

3. The method of claim 1 wherein at least one node which lies on one of the boundaries between the finite element meshes is

not common to all of the finite element meshes which touch the corresponding boundary.

4. The method of claim 1 wherein the each function is distinct from the other functions.

5. The method of claim 4 wherein at least two of the functions are not continuous with each other.

6. The method of claim 1 wherein one of the finite element meshes corresponds to a first portion of an oil reservoir and another of the finite element meshes corresponds to a feature within the oil reservoir, and wherein the feature is selected from the group consisting of: a fracture; a completion zone; a damage zone; a geological stratum; and a near well region.

7. The method of claim 1 wherein defining the plurality of finite element meshes comprises defining a plurality of two-dimensional finite element meshes and extruding the two-dimensional finite element meshes in a third dimension to obtain three-dimensional finite element meshes.

8. The method of claim 1 wherein defining the plurality of finite element meshes comprises defining a first finite element mesh to include both a first region and a second region

corresponding to the modeled system, refining the first finite element mesh to carve out the second region, and defining a second finite element mesh within the second region.

9. The method of claim 8 wherein refining the first finite element mesh to carve out the second region comprises defining a boundary surface between the first region and the second region, adapting the first finite element mesh to define elements having surfaces which lie substantially on the boundary surface, defining the first finite element mesh as the elements on a first side of the boundary surface and defining the second finite element mesh as the elements on a second side of the boundary surface.

10. The method of claim 1 wherein adapting the first finite element mesh comprises identifying intersections of edges of the elements of the first finite element mesh with the boundary surface, defining nodes at the identified intersections, and refining the elements of the first finite element mesh to incorporate the newly defined nodes.

11. A method for modeling an oil reservoir using finite element analysis, wherein the reservoir has a plurality of adjoining regions corresponding to the reservoir and one or more features within the reservoir, wherein each of the regions is characterized in a corresponding finite element model, and wherein for a selected property of the reservoir each finite

element model employs an independent function to represent the selected property, wherein the method comprises:

associating an evaluator with each of the finite element models; and

generating a solution for each of the finite element models;

wherein generating the solution comprises calculating a solution based on the value of the selected property at each of the nodes in the finite element model, wherein for each of one or more nodes which lie on boundaries between the finite element model being solved and one or more others of the plurality of finite element models, the value for the selected property is dependent upon the evaluator associated with the finite element model being solved.

12. A computer readable medium containing instructions which are configured to cause a computer to perform the method comprising:

defining a plurality of finite element meshes, wherein a plurality of nodes are common to at least two of the finite element meshes;

defining a property associated with each of the finite element meshes, wherein for each of the finite element meshes, the property is defined by a corresponding function which is independent of the other functions;

associating an evaluator with each of the finite element meshes; and

generating a solution for each of the finite element meshes, wherein for each of the finite element meshes, the function used to define the value of the property at each of the common nodes is selected according to the evaluator associated with the finite element mesh.

13. The computer readable medium of claim 12 wherein defining the plurality of element meshes comprises defining all nodes on boundaries between the finite element meshes to be common to the finite element meshes which touch the corresponding boundaries.

14. The computer readable medium of claim 12 wherein at least one node which lies on one of the boundaries between the finite element meshes is not common to all of the finite element meshes which touch the corresponding boundary.

15. The computer readable medium of claim 12 wherein the each function is distinct from the other functions.

16. The computer readable medium of claim 15 wherein at least two of the functions are not continuous with each other.

17. The computer readable medium of claim 12 wherein one of the finite element meshes corresponds to a first portion of an oil reservoir and another of the finite element meshes corresponds to a feature within the oil reservoir, and wherein the feature is selected from the group consisting of: a fracture; a completion zone; a damage zone; a geological stratum; and a near well region.

18. The computer readable medium of claim 12 wherein defining the plurality of finite element meshes comprises defining a plurality of two-dimensional finite element meshes and extruding the two-dimensional finite element meshes in a third dimension to obtain three-dimensional finite element meshes.

19. The computer readable medium of claim 12 wherein defining the plurality of finite element meshes comprises defining a first finite element mesh to include both a first region and a second region corresponding to the modeled system, refining the first finite element mesh to carve out the second region, and defining a second finite element mesh within the second region.

20. The computer readable medium of claim 12 wherein refining the first finite element mesh to carve out the second region comprises defining a boundary surface between the first region and the second region, adapting the first finite element mesh to define elements having surfaces which lie substantially on the boundary surface, defining the first finite element mesh as the

elements on a first side of the boundary surface and defining the second finite element mesh as the elements on a second side of the boundary surface.